IMPLEMENTATION OF ORDERING KANBAN FOR SUPPLIER AT COMPANY PROREKA (M) SDN BHD

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ABSTRACT

Lean Production System is a manufacturing management in which time can be shortened for customer order and delivery time; and service parts order can be increased through the elimination of all forms of waste. The main component for "Just-In-Time", one of the pillars of Lean production System is "Pull System" or Kanban System. Kanban system is a pull system of inventory control that typically uses cards or bins to signal when materials or work-in-process should be moved forward; stock inventory is moved through production stages only when it is needed, and minimizing stock inventories. This is an important revolution in the concept of the Lean Production System. The objective of this research is to simulate Kanban policies for three major materials in warehouse of Proreka (M) Sdn Bhd which is a Malaysia Tier-1 vendor and manufacturer of automotive components. Another objective is to investigate the stock control efficiencies between Material Requirement Planning and Kanban System. The main target of this research is to implement small lot ordering by using Kanban policy to reduce the stock inventories. A simulation model of delivery frequency was developed for the replenishment process of the selected stocks to analyse the delivery frequency from supplier after Kanban implementation. The average stock holding before and after Kanban implementation was analysed to compare the stock control effectiveness between Material Requirement Planning and Kanban System. Interview session and survey by questionnaire were conducted to analyse the performance of Kanban System in point of view of employees. The result obtained indicated that Kanban policy can reduce stock inventories and improve the efficiency in stock control. Other significant improvements with the implementation of Kanban are such as physical condition of the manufacturing environment, production efficiency, and motivation of workers.

ABSTRAK

Sistem Pengeluaran Berpada adalah pengurusan pembuatan yang membolehkan masa untuk pesanan pelanggan dan masa penghantaran dipendekkan, dan perkhidmatan untuk komponen dapat dipertingkatkan melalui penghapusan semua bentuk sisa. Komponen utama bagi "Just-In-Time", salah satu tunggak Sistem pengeluaran Berpada adalah "Sistem Tarik" atau Sistem Kanban. Sistem Kanban adalah sistem tarik kawalan inventori yang biasanya menggunakan kad atau bekas bertutup untuk memberi isyarat apabila stok atau kerja dalam proses harus bergerak ke hadapan; stok inventori bergerak melalui peringkat pengeluaran hanya apabila ia diperlukan, dan meminimumkan stok inventori. Ini adalah revolusi penting dalam konsep Sistem Pengeluaran Berpada. Objektif kajian ini adalah untuk mensimulasikan polisi Kanban pada tiga stok utama dalam gudang Proreka (M) Sdn Bhd yang merupakan vendor dan pengilang komponen automotif tahap satu dalam negara Malaysia. Objektif lain adalah untuk menyiasat kecekapan kawalan stok antara Perancangan Keperluan Bahan dan Sistem Kanban. Sasaran utama kajian ini adalah untuk melaksanakan pesanan lot yang kecil dengan menggunakan polisi Kanban untuk mengurangkan inventori stok. Model simulasi bagi kekerapan penghantaran untuk proses pengisian semula bagi stok yang dipilih dihasilkan untuk menganalisis frekuensi penghantaran daripada pembekal selepas perlaksanaan Kanban. Purata pegangan stok sebelum dan selepas perlaksanaan Kanban dianalisis untuk membandingkan keberkesanan kawalan stok antara Perancangan Keperluan Bahan dan Sistem Kanban. Sesi temuramah dan kaji selidik dengan pengunaan borang soal selidik dijalankan untuk menganalisis prestasi Sistem Kanban dari persepsi pekerja. Hasil kajian yang diperoleh menunjukkan bahawa dasar Kanban boleh mengurangkan stok inventori dan meningkatkan kecekapan dalam kawalan stok. Peningkatan lain yang ketara dengan perlaksanaan Kanban adalah seperti keadaan fizikal persekitaran pembuatan, kecekapan pengeluaran, dan motivasi pekerja.

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LIST OF ABBREVIATIONS

CAD	Computer Aided drafting
CAM	Computer Aided Modelling
CP	Childpart
DI	Delevery Instruction
FG	Finish Good
FIFO	First In First Out
JIT	Just In Time
LPS	Lean Production System
MRP	Material Requirement Planning
OEM	Original Equipment Manufacturer
PPC	Production Planning and Control
QA	Quality Assurance
R&D	Research and Development
SOP	Standard Operating Procedure
TPS	Toyota Production System
VSM	Value Stream Mapping
WIP	Work In Progress

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In this challenging world of globalization and the internet with no limitations, competitive is a challenge and obstacles that cannot be avoided by the respective small, medium and large industries. Global manufacturing enterprises continually strive to improve their respective manufacturing operations to regain a competitive advantage particularly in the automotive and computer industries. Now, a target of raising the level of productivity, operational capability and efficiency in all areas of production (operations) is to be a priority at all enterprises.

Competitiveness in any industry these days is dependent on time, manufacturing cost and marketing in the making [1]. Traditional mass production manufacturing is not particularly responsive to changing customer demands, for it relies on forecasting future demand and scheduling the release of work into the system to meet expected demand. In the past, the company or the industry required a great effort of time and energy towards marketing and customers' needs. Mass production systems often have excess inventory, higher WIP levels, and longer quoted lead-times from order to delivery. These factors have led the participants from the industries to take steps in exploring the LPS and also the techniques in the system.

Kanban, meaning “card” in Japanese, contain information such as the part name, job type, and the quantity of parts to carry. In the system, Kanban flow and Kanban type have become crucial in production management. With the movement of

the cards, information becomes tangible and easily understood. Kanban system is more widely known and recognized type of pull system. Kanban pull system is sometimes referred to the just-in-time (JIT) manufacturing using a Kanban pull system in Toyota Production System [2]. The key principal of Kanban system is to deliver or pass the material and information just-in-time to the preceding stage regarding what and how much to produce. The process includes material and child-part ordering from suppliers to deliver in small lot but higher frequency of delivery in order to reduce stock inventory.

To satisfy the small lot ordering from the customers, most suppliers (mainly Small and Medium Enterprises) have to use the concept of "Customize Order" [3]. These industries are also responding to the challenge of e-commerce and customer ordering via the Internet by shifting to re-configurable manufacturing equipment and a make-to-order environment. Based on the efforts towards the path to success based on Lean Manufacturing System (LPS), a study of Supplier Ordering Kanban System Implementation was conducted in company Proreka (M) Sdn. Bhd.

1.2 PROBLEM STATEMENT

Lean Production is about constantly finding the most convenient solutions possible. It concerns everything from eliminating unnecessary waste to giving customers exactly what they want. The concept was introduced in Japan by Toyota. That is also where it was refined and tested. Today, decades later, the thoughts and ideas have spread all over the world to thousands of companies.

According to the customers' needs nowadays, most customers require suppliers to provide products and confirmation after an order is issued. In the past, there are customers who requested that the product delivered after one or two weeks, but now, customers request items will be sent after three or four days only after order confirmation is issued. This is also different in terms of amount of orders, as it must be remembered that the customer also implemented LPS to reduce the amount of items ordered (small lot). This makes the implementation of the Kanban system

become a priority, as Kanban principles is to help in our efforts to satisfy the customer and reduce our stock inventories.

Because of the higher orders from the customer, PPC department is difficult to make plans accurately because of the lack of information on the actual total stock. They also had to check the stock for each item for two times a day, or each supervisor for each section will give the stock. We can see how difficult this work, instead of once a week than everyday.

Therefore, this study is conducted to implement Kanban system in ordering process as it is one of the LPS method to reduce the problem of high stock inventories and to improve the effectiveness of stock control.

1.3 OBJECTIVES OF THE RESEARCH

i. To simulate Kanban policies for three major materials in warehouse of Proreka (M) Sdn Bhd

The main purpose of this project in the company is to reduce stock inventories of three chosen major high running materials at warehouse. A Kanban system is a pull system of inventory control that typically uses cards or bins to signal when work-in-process should be moved forward. With Kanban system, stock inventory is moved through production stages only when it is needed, minimizing stock inventories. Instead of directly controlling the throughput, Kanbans (cards) are used to authorize production or transportation of materials such that the parts are pulled and stock is visualized and controlled. The constant number of cards used in a Kanban system, and the limited lot sizes of the attached containers create an upper limit on the stock level and the finished good inventory.

ii. To investigate the stock control efficiencies between Material Requirement Planning (MRP) and Kanban System

Another purpose of the Kanban system is its ability to control production. In a "pull" controlled system, the start of a job is triggered by the completion of an earlier job. Control of stock becomes much easier and hence can be significantly reduced in a pull system. In the Kanban control system, Kanbans are used to control and limit the releases of parts into each production stage. The advantage of this mechanism is that the number of parts in every stage is limited by the number of Kanbans of that stage.

1.4 HYPOTHESIS OF THE RESEARCH

The small lot ordering in Kanban policy by increasing the delivery frequency may reduce the stock inventories of selected part in warehouse and improve the efficiency in stock control.

1.5 SCOPE OF PROJECT

i. This project was held at Proreka (M) Sdn. Bhd. under Production Planning and Control (PPC) Department in Planning Division to plan and implement supplier Kanban for part ordering.
ii. It covered the entire area in warehouse storage.
iii. The study was done only for 3 major materials which have the highest ordering frequency.
iv. The study was done on chosen materials only after have the agreements from the related suppliers.
v. The main target of this project is focusing on reducing stock inventory to an upper limit of six days and lower limit of three days by using the principals of Kanban system which set by the PPC department of company Proreka (M) Sdn. Bhd.The upper limit is refer to the maximum stock holding day while the lower limit is the minimum

stock holding day which is including the buffer/safety stock holding day. Buffer stock is a cushion of supply in excess of forecast demand, and it is intended to reduce the incidence or severity of stock-out situations and thus provide better customer service.

CHAPTER 2

LITERITURE REVIEW

2.1 INTRODUCTION

The second chapter describes in general on LPS and the principle behind the system as well as the history that LPS was conceived and designed. This chapter also describes Kanban perspective in terms of journal papers, books and past experience. By taking the Kanban as one of the LPS method, a useful description and advantages of the system will be discussed. LPS is a name taken from the name Toyota Production System (TPS) and to avoid confusion due to automotive manufacturing in Malaysia such as Produa and Proton, the word “Toyota” of TPS has changed to the word "Lean" [4].

2.2 HISTORY OF LEAN PRODUCTION

The origin of the TPS or LPS is the combined effort of Mr. Sakichi Toyoda, who was also a thinkers and creators. He grew up in the late 1800s in a rural farming community in Nagoya, Japan. Toyoda began to learn the art of carpentry and methods of machine design to build a wooden detour from his father. In 1894, he began to repair and upgrade her mother's loom. This is all done without the guidance of anyone, only on the basis of his knowledge that he learned at university in Tokyo. His purpose was to develop a cheaper machine and more efficient than the loom at that time [5]. Looking at the grandmother and his mother worked hard to spin and weave cloth with a manual loom, Toyoda trying to develop a machine that will automatically wove the fabric. Finally he has succeeded in developing a sophisticated automatic power loom. Among his designs, there is a special

mechanism that will stop the machine automatically when there is a yarn needle break. This invention has led to the concept of Jidoka means automation.

Mr. Kiichiro Toyoda, son of Mr. Sakichi Toyoda was inspired by the supermarket system in the United States when he was visiting and doing a research related to the Ford Company. After World War II, the Americans realized the need for trucks to rebuild Japan. This indirectly has helped Toyota start to build their automotive plant. At the time the economy starts to gain momentum, Toyota faced a critical resistance when there were only orders for manufacturing small cars. The evidence of high inflation and the currency became lower or almost no value causing a more difficult situation. To overcome the financial environment at that time, Toyota adopted stringent cost control policies. These include voluntary salary cut from the management and ten percent salary cut for all employees. Without other choice, Mr. Kiichiro had requested a total of 1,600 workers to retire voluntarily. This has caused the workers to strike work and held public demonstrations [6].

Finally, Mr. Kiichiro accepted the responsibility for this failure and resigned his post as president. Many workers have quit voluntarily, but they returned to work at the company when the customer orders have been increased after a few years later. Before the Second World War broke out, Toyota has realized that the Japanese market and the demand were too small compared to the market in the United States. Large competitor such as the Ford has a lot of money and markets throughout the United States and international but Toyota does not have the cash and only operating in a small country (Japan). With limited resources and capital, Toyota strives to change the cash flow quickly. Ford Company has a complete manufacturing system, but the Toyota does not exist. Toyota cannot afford to hold large-scale production systems such as Ford. Toyota realized that they should have a different production system. It is to mimic the Ford system in their manufacturing process to achieve high quality, low cost, short time customer orders, and the system can be adjusted. Toyota also intends to produce a car with a low number of orders (low volumes car) with a different model but using the same assembly systems [6].

This situation has led to the birth of the concept of LPS. Mr. Kiichiro Toyoda, who is the president of Toyota Motor company at that time have acknowledged that American car manufacturers of the era were able to produce cars more quickly than manufacturers in Japan about factor of ten [7]. Early Japanese industry leaders such as Toyoda, Shigeo Shingo and Taiichi Ono have created a new system, discipline and process-oriented, known as the "Toyota Production System" (TPS) or LPS [8].

TPS or LPS are designed to be a manufacturing system that can decrease the cost. This is made possible through the elimination of waste. The main attributes are supported between two poles of JIT and Jidoka which are the basic key principles of work and continuous improvement (kaizen) [9]. Figure 2.1 has shown the TPS or LPS structure diagram created by Toyota. JIT is a way to make product based on: what is needed, when it is needed and in quantities needed. Jidoka is the machinery or equipment or jigs that are created to ensure the product in perfect quality and to avoid error through automation.

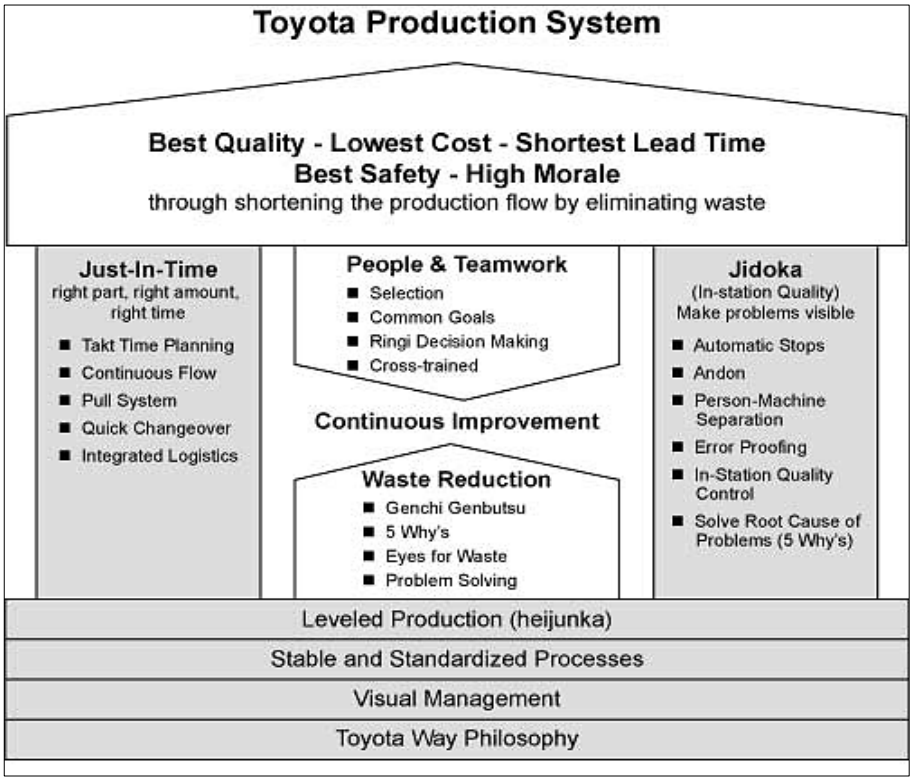

Figure 2.1: Production System Developed by Toyota Motor Corporation

Source: J. Liker (2004). The Toyota Way. McGraw-Hill. pg. 33

According to Mr. Taiichi Ono, the father of the Toyota production systems, the main principle of LPS is to remove waste (Muda) where Muda is any activity which consumed resources but creates no value [9]. One of the purposes of LPS is the reduction in waste and adding value to the manufacturing system so that system performance can be improved significantly and the company can "do more with less" [10]. The concept of LPS has begun spreading to the factories in Japan after it was first implemented in the Toyota Motor [11]. The LPS was used to reduce the time from customer order to delivery of finished products [12].

When the crisis of higher oil prices in autumn 1973 followed the entire world economy began to show genuine interest in the LPS [13]. This also includes the American companies began to learn and imitate LPS from Japan. Manufacturing system of these manufacturers was enhanced after implementing LPS. This indirectly has enabled them to react to market changes quickly, enabling companies to continue operate even in difficult times and also to maintain profits during economic conditions change [14].

The goal of LPS is to increase the productivity by eliminating non-value added waste in the enterprise. Starting from Mr. Sakichi Toyoda to Kiichiro Toyoda in the past and until now, they are also among the sculptors Toyota history.

2.3 LEAN PRODUCTION SYSTEM (LPS)

Efforts to achieve efficiencies in manufacturing have created inspiration and interest from various fields of manufacturing. The ideas and concepts are still considered the best and can be used by many manufacturing companies around the world which in turn led to the creation of a concept or philosophy known as LPS or simply known as "Lean". Lean Manufacturing System has five processes, which are the value of customers, ensuring that the action, making the process flow, attract customers and strive for excellence [15]. LPS is a manufacturing management or management of psychological field in which time can be shortened for customer order and delivery time and service parts order can be increased through the elimination of all forms of waste. "Lean" helps in efforts to decrease costs, cycle time,

and all activities that have no added value. This will enhance the competitiveness of company in order to become more competitive, agile and more economical [16].

The concept of LPS was originally developed for the Toyota Motor Cooperation by Mr. Taiichi Ono. It is not a new system, in the early 1920s, many concept of "Lean" has been practiced at Ford Motor Company. Mr. Ono learnt from Ford's book, where he took inspiration from this concept, study the "flow of an ongoing process" and mass production methods which were used in the Ford assembly line. By increasing number of manufacturing activities and techniques learned from Ford has been adopted in Toyota's manufacturing plants, Mr. Ono continues to develop this system, and finally it was known as the TPS, also known as LPS. In line with this, Ono taking JIT as part of the LPS and the success of implementation terms of techniques and principles are very stimulating [17].

LPS must have the ability to achieve and maintain a small amount of production (small batch production) so that they can meet the demands of the market quickly. Information exchange flow is a basic technique for the production of JIT or Kanban system to maintain the quality, adaptability and responsiveness [18]. JIT or Kanban system is a set of principles, a tool and a technique that allows a company to produce and deliver products in small quantities, with short lead time, to suit the needs of customers. Thus, Kanban helps to send the right product at the right time and in the right amounts while JIT will led to a strong need for workers to receive orders and customer requests on a daily basis, this is a concept created by Toyota [17].

Many of the ideas created by Toyota in the 1940s and the early 1950s were related to the LPS for the automotive industry can be considered as a high level on the world stage. In fact, many people consider Toyota as world leader in the field of automotive manufacturing [7]. Products and services delivered through JIT production, which means that produce in the right amounts, at the right time, and standards provided.

LPS has four goals to be achieved as follows [19]:

i. Improving the quality
ii. Avoid wastage
iii. Reduce time
iv. Reduce waste

LPS stands for "manufacturing without waste" [20]. Waste in Japanese, Muda is defined by Fujio Cho of Toyota as any other than the minimum amount of equipment, materials, components and labor (hours worked) is important to production [21]. LPS most often associated with normal waste removal kept by the company such as excess inventory or excess capacity (machines and human capacity) to improve the effects of changes in supply, processing time, or on request [22]. LPS approach is to focus on the systematic elimination of waste at the current value (value stream) [20]. The concept of waste encompasses all possible work or activities for the handicapped, not only a defective product. Toyota has identified eight waste that has no added value, which is found in the field of manufacturing business as described in the book "The 14 Toyota Way" [17].

i. Excessive Production: Produce a product without orders, and when the product is stored, it is said to be wasteful in terms of place and staff available to deal with it.
ii. Waiting-time: Employee who is watching a moving machine or just waits for the next processing step. Delay in processing, on the other hand, the machine is damaged, or / and more capacity. (Time to work more than the cycle time).
iii. Transportation: Bringing semi-finished products or WIP for a considerable distance, using the transport system that inefficient, or finished goods brought into or out of stock or between processes.
iv. Excessive processing or incorrect processing: Processing steps that are not needed for processing the product. Inefficiencies in the process due to machine manufacturing or assembly jig or product designs that do not meet the installation methods, will lead to process or movement

that is not necessary and sometimes can produce products that have defect.

v. Excess Inventory: Excess raw materials, semi-finished products or finished goods will result in the product stored for a longer time, or the goods are damaged (but still kept). Excess inventory can result from other problems such as imbalance in the number of materials or child-part. Late delivery by suppliers, product defects, or delays in shipments to customers are also included in the excess inventory.

vi. Movement: Non-need-movement act by an employee while at work, such as finding things, achieve the goods from high and far places, and superposing the goods or equipment (to be reduced if necessary). Walking is also considered as a waste.

vii. Defects: Production of the damaged / defective or rebuild such as products to be repair or renovation, disposal, production for a replacement, and re-examination of employment are considered waste of time, energy and effort.

viii. Waste of intelligence of workers: Time, ideas, skills, and learning opportunities will be wasted by the employee if they did not communicate or spend some time with other employees.

2.4 JUST-IN-TIME (JIT)

There are two main pillars in the LPS created by Toyota shown in the Figure 2.1 which are JIT and Jidoka. JIT refers to the production and delivery of what is needed, when it is needed, in a timely manner and amount required. It is one of the methods in manufacturing system in inventory control for each process. JIT may also shorten cycle times and provide a relatively high cost reduction. It also has benefits related to the quality and motivation for employees indirectly. In JIT production, it meets the requirements or demand in controlled (card), each movement is pulled through the system work; according to the requirements at each level or division and the rate of each stage of goods or parts [23]. JIT production has adopted three methods of operation such as [5]:

i. Pull system (Kanban system)
ii. Continuous flow processing
iii. Quick changeover
iv. Takt time planning

Continuous flow processing and shorten the cycle time of manufacturing process will ensure the consistent of process for the production plant. Kanban system is a regulatory mechanism to prevent overproduction and to control the balance of stock in the manufacturing process. Accurate information related to the stock can also be given at any time. The above three principles are a necessary precondition so that it can operate effectively to meet Heijunka (balance output). This is one of the production planning and control systems in LPS [5]. JIT emphasizes the concept of zero, the achievement of goals such as zero defects, zero waiting time, zero inventories, zero damage, and so forth [24]. This is the key to practice where each process in JIT (if it is successfully carried out), will enable the company to experience the maximum benefits.

Push and Pull system are two types of production systems, which operate equally in opposite sense and have their own merits and demerits [29][30]. Push system is a conventional system of production. When a job completes its process in a workstation, then it is pushed to the next workstation where it requires further processing or storing. In this system, the job has a job card and the job card is transferred stage by stage according to its sequence. In this method, due to unpredictable changes in demand or production hinder-ness, the job happens to deviate from its schedule and it causes accumulation of work-in-process inventory. Hence, inventory planners pessimistically fix the safety stock level on the higher side.

By providing an average or balance level of total production for a cycle of Kanban is the first step in preparation of JIT. The average number is the basis to determine the number of machines required, number of products for a cycle or the amount of raw materials required and labour required for the manufacturing processes that meet the needs of customers' orders. This is because when the production is complex and unstable, the setting of same level or average production

per month is not easy [5]. If several different model numbers is sent to the assembly of uncertainty, then the process in each section will be exchanged frequently. It will be confusing for employees and mistakes will occur, and thus will lead to the production or assembly process to be delayed or even stopped. Defect on the quality and supply imbalance will result in increased costs [5].

A schematic representation of the push system is shown in Fig. 2.2. In the pull system, from the current workstation (j), each job is withdrawn by its succeeding workstation (j+1). A pull type production system consists of a sequence of workstations involving value addition in each workstation (WS). In other words, the job is pulled by the successive workstation instead of being pushed by its preceding workstation. The flow of parts throughout the product line is controlled by Kanban Cards [31]. The primary advantage of the pull system is the reduced inventory and hence the associated cost of inventory reduction. A schematic view of the pull system with two workstations and store is shown in Fig. 2.3.

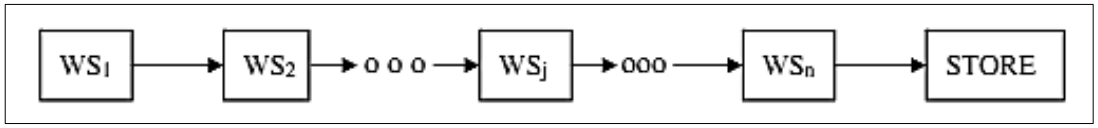

Figure 2.2: Push System

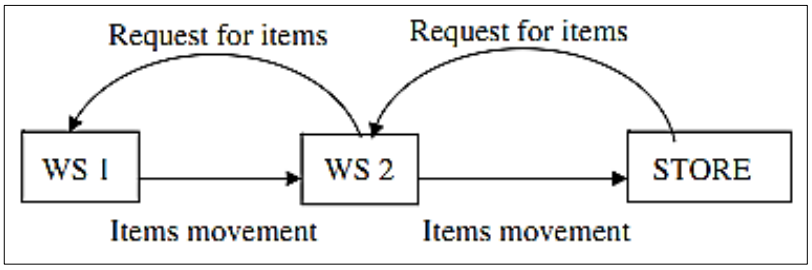

Figure 2.3: Pull System